counts of tornado disasters are filled with reports of escapes that seem little short of miraculous and of sudden deaths from falling timbers, bricks, and stones.

The old-time "cyclone cellar" or outdoor cave has probably been the means of saving more lives from tornadoes than anything else and is still one of the best places of refuge ever contrived. The southwest corner of the basement of a frame house is almost as safe, especially if a person crouches close against the wall. Tornadoes nearly always approach from the south or west and flying débris or perhaps the house itself will be carried away from the southwest corner. The basement of a brick or stone house is liable to be a death trap in a tornado as brick or masonry walls are liable to collapse and tumble down anywhere.

A person caught in the open when a tornado approaches has a choice of lying down flat in a depression or of flight. Tornadoes travel across the country at a rate of 30 to 60 miles per hour, usually, and escape for a person in an automobile is simple if there are highways open. A person on foot directly in the path of such a storm should run toward the northwest, which is at right angles to the storm path and toward the side where the winds are least violent.

For a person caught in the business section of a city when a tornado is approaching perhaps the best chance would be to stand close to an inside partition of a modern reinforced steel and concrete building. Architects believe such buildings will resist side winds of a tornado and possibly to a considerable extent the full force of such a storm, though this has not been established definitely. In any case outside walls are more likely to be blown out than inside partitions and the latter might serve to protect against débris that falls from upper stories.

ÅNGSTRÖM ON RECORDING SOLAR RADIATION: A STUDY OF THE RADIATION CLIMATE OF THE SURROUNDINGS OF STOCKHOLM

551.590.2 (485)

By HERBERT H. KIMBALL

[Meddelanden Från Statens Meteorologisk-Hydrografiska Anstalt. Band 4. No 3; 36 pp., 2 Pl. 23 text fig.

In his preface the author states that:

It is desirable that the results as regards the total radiation income from the sun and sky be brought into relation, not only with the variation of the dark outgoing radiation, but also with the radiation within special limited parts of the spectrum. In fact it is planned to add later to the present study a detailed treatment of these last-named questions.

The following quotations are from the introduction:

Practically all the energy conveyed to the earth and its atmosphere is furnished by the radiation from the sun; and the only way in which this energy is able to escape from the system is through radiation back to space from the surface of the earth and from the atmosphere. Together with the processes of atmospheric circulation, through which advection and convection of heat is sustained, this uninterrupted exchange of radiation determines the horizontal and vertical distribution of temperature within the atmosphere. In fact, these two groups of phenomena, the circulation and the radiation processes within the atmosphere, are involved in one another to such a degree that it seems scarcely appropriate to speak of the one as more fundamental than the other. So much seems certain, however, that we shall never arrive at a clear understanding of the weather and its causes, without a detailed knowledge of the way in which radiation produces atmospheric circulation, and the latter, in its turn, acts back upon the radiation exchange itself.

The fundamental groundwork for such a knowledge must be obtained through observations and quantitative measurements.

The importance is stressed of measurements of the total radiation (direct + diffuse) in both clear and cloudy weather. Subtracting from this total the "effective temperature radiation of long wave length," often called "nocturnal radiation," there remains the "heat effective net radiation," which is available for "raising the temperature of soil, or water, or air, and for evaporation, melting, and other processes of transformation of water."

* * * * *

The total radiation income from sun and sky determines what we may call the illumination climate of a place, and for many purposes a measure of the former quantity gives also a sufficiently accurate measure of the natural illumination.

* * * * *

The light from sun and sky is a necessary condition for the assimilation of plants, but all the different wave-lengths have not the same effectivity. Engelman finds two bands especially effective, one in the red between 650$\mu\mu$ and 700$\mu\mu$, the other in the blue at about 480$\mu\mu$. * * * It seems probable, however, that the effectivity of different groups of wave lengths is variable from case to case, and that for different plants or in different periods of growths of the same plant the one or the other group of radiation may play the most important part.

For the first orientation we may regard the total radiation income from the sun and sky as a satisfactory relative measure of the intensity of light that is active in the processes of assimilation in nature.

* * * * *

More and more the important part played by light for the health and comfort of man is beginning to be realized. * * * In what way this light acts on the human organism is still very little known. One of the chief conditions for further development is a thorough knowledge of the quantity and quality of the stimulant under various conditions.

Chapter 1 discusses "Instruments and Principles of Measurement." Much of what is given has been published previously,[1] but improvements in both pyrheliometer and register are described and instrumental errors are discussed.

Chapter 2 gives the results of measurements. For the period April, 1926–August, 1927, hourly, daily, and monthly totals of radiation as measured on a horizontal surface are given, and also monthly means of the hourly totals. There is also given the maximum recorded intensity for each day, which the author states does not occur during perfectly clear days, but when the sun is shining between clouds which reflect the radiation they receive The highest recorded intensity is 1.725 gr.cal. per minute per square centimeter, in June, 1927.[2]

Annual and monthly totals are given for the period July, 1922–December, 1927. The average daily totals for cloudless days, and for days with the sky completely covered with clouds, have also been computed for each month. With a clear sky the highest average is 650 gr.cal. in June and the lowest 50 gr.cal. in December.

Let Q_o = the daily total radiation with a cloudless sky.
Q_s = the daily total radiation with the sky covered with clouds.
S = the ratio of the recorded hours of sunshine to the possible hours (time from sunrise to sunset).

Then Ångström finds that

$$Q_s = Q_o(0.235 + 0.765\ S)$$

[1] MONTHLY WEATHER REVIEW, 1919, 47: 795; 1921, 49: 135.

[2] The legend to Figure 21 states that the three curves give momentary maxima, mean noon, and minimum noon intensities for each month during clear days. This appears to be misleading in so far as the two last-named curves are concerned, since they seem to represent the average and the minimum values irrespective of cloudiness.

He remarks upon the significance of the close agreement between this equation and one found by the reviewer to apply to Washington, namely.

$$Q_s = Q_o(0.22 + 0.78\ S)$$

With his equation Ångström computed monthly totals for the period January, 1905–June, 1922. The annual radiation curves thus computed agree well with the curve based upon observed values. He points out, however, that the probable error of monthly totals thus computed, and especially for winter months, is large, but is small for annual totals. Annual totals thus computed have therefore been employed to show variations in the annual radiation receipt over the period 1905–1926.

From the measured monthly totals of solar radiation and computations by Westman of the total radiation received on a horizontal surface directly from the sun, Ångström has computed the percentage of the total radiation that is included in the diffuse radiation. For the year he finds it to average 30 per cent, but in different months it varies from 87 per cent in December to 19 per cent in July. For clear-sky conditions, for the year the percentage is 12.5; for December, 46; for July, 1.1; and for June 2.7 per cent. These percentages appear to be entirely too low. (See MONTHLY WEATHER REVIEW, October, 1924, 52:475, Table 1.)

The author shows that the annual variation in the total radiation receipt may be expressed by a Fourier series. He develops the series for nine stations at which records of the total radiation receipt were available to him. They vary in latitude from Stockholm, 59° 21′ N. to Lourenco Marques, 25° 58′ S.; and in altitude from 37 meters for South Kensington, England, to 1,600 meters for Davos, Switzerland. The term representing the average monthly value for the year varies from about 5,700 at South Kensington to over 12,000 at Lourenco Marques and Davos. The first periodic or average annual term varies from about 2,800 at Lourenco Marques to 7,100 at Davos, and the second periodic or semiannual term varies from 375 at Toronto to 1,360 at Davos. The maximum monthly value occurs at about the time of the summer solstice at all stations in the Northern Hemisphere, and shortly before our winter solstice in the Southern Hemisphere.

Under "Concluding Remarks" the author refers to the significance of marked departures from the normal in individual records, and suggests the following problems as of special interest:

1. Influence of different forms of clouds on the radiation exchange. Studies of the regular and diffuse reflection from clouds. Influence of clouds on different rays.
2. The records of the diffused radiation from perfectly overcast skies give possibility to follow the variations in the density and mass of clouds. A study of the relation to the synoptic situation seems desirable.
3. A study of the relation between the rapid fluctuations in radiation caused by cumulus clouds and the variations in temperature resulting herefrom.
4. Structure of clouds in the neighborhood of lines of discontinuity.
5. Studies of the diffused radiation from overcast skies for various wave lengths at the moment when rain begins to fall.

We have to thank Doctor Ångström for pointing the way in which radiation studies may be directed. As he truly states, cooperation on the part of many workers will be necessary for the complete solution of some of the problems presented. International commissions are already in existence to facilitate such cooperation.

C. E. P. BROOKS AND W. QUENNEL ON THE INFLUENCE OF ARCTIC ICE ON THE SUBSEQUENT DISTRIBUTION OF PRESSURE OVER THE EASTERN NORTH ATLANTIC AND WESTERN EUROPE [1]

551.467(98):551.54(4)
(261.2)

By ALFRED J. HENRY
[Weather Bureau, Washington]

In a previous publication an attempt was made (2) to discover whether small changes in the temperature and volume of the Gulf Stream due to variations in the strength of the trade winds and other factors, were reflected in later changes in the pressure distribution of the eastern North Atlantic. Some definite though small effects were noted; since, however, the Gulf Stream is not the only oceanic factor that may be expected to influence the weather of the British Isles, it seemed desirable to investigate the effects which reasonably may be attributed to variations in the temperature and ice distribution in the Arctic Ocean, the Greenland Sea, and the neighborhood of Newfoundland.

Figure 1 shows the area considered, the meteorological stations whose records were utilized and a sketch of the ocean currents.

Ice appears to be formed chiefly in two parts of the north Polar Basin, viz, the area of open ocean north of Asia and the channels among the islands of the American Arctic Archipelago; the inland ice sheet of Greenland also is an important auxiliary source.

The first step in the investigation is a discussion of the tracks and average speeds of the ocean currents which carry the ice from one part in the basin to another and eventually into lower latitudes.

It has been pointed out by Wiese (3) that the greater part of the ice which finds its way into the east Greenland current is formed by the freezing of the layer of fresh water north of the mouths of the great Siberian rivers and Wiese terms this region the "factory of northern Polar ice."

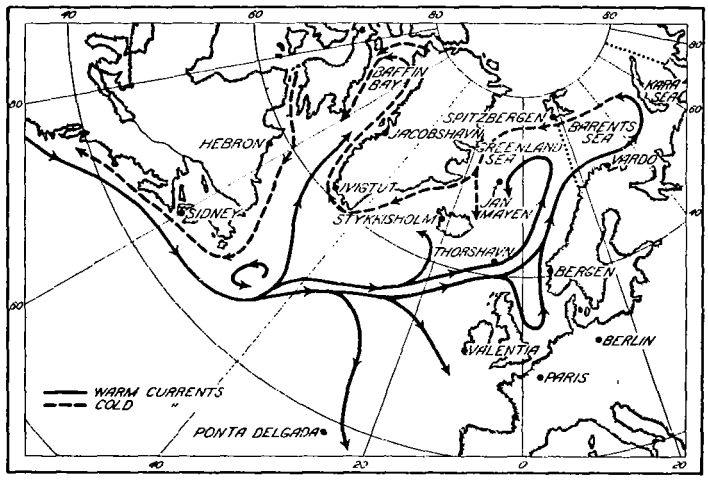

FIGURE 1.—North Atlantic and Arctic showing divisions, stations, and ocean currents

[1] Air Ministry, Meteorological Office, Geophysical Memoir No. 41 (first number of Vol. V), by C. E. P. Brooks, D. Sc., and Winifred Quennel, London, 1928. Pressure distribution over the Greenland-Iceland region is at times an important factor in determining the course followed and speed of movement of cyclones that reach northeast United States and Canada. For that reason the memoir here under review is especially welcome.—ED.